

A STUDY OF THE STACHYS PALUSTRIS L.
COMPLEX (LABIATAE) IN NORTHERN NORTH AMERICA*

L.S. GILL

Department of Biological Sciences,
University of Benin,
P.M.B. 1154,
Benin City, Nigeria

Stachys palustris is a widely occurring species distributed throughout temperate Eurasia and North America. It is very variable in such characters as habit, pubescence, leaf shape and serration, calyx structure, and corolla size and colour. In North America this species is particularly variable and several attempts at a taxonomic treatment have been made by previous workers. Rydberg (1904, 1906 and 1932) described several new species from western North America, all of which are referable to the S. palustris complex. Jennings (1920) described 3 new varieties from northwestern Ontario. Epling (1934) recognized 2 subspecies but included other forms in S. rigida Nutt. and so called S. x ambigua Smith. Fernald (1943) recognized 5 varieties based on leaf and pubescence.

All these workers however based their conclusions purely on a study of herbarium material together with their knowledge of these plants in the field. In the present study I have coupled such observations with others on the cytology and behaviour of the plants under cultivation, in an attempt to produce a more satisfactory treatment of variation in this species within North America.

Living material from 45 populations of Stachys palustris, collected in localities throughout the greater part of its range in North America were brought into cultivation at Waterloo. Type material of the numerous species, varieties and forms which have been described from North America by previous workers and which appear to belong to this species complex, was examined to ensure that all the known variants were included in the cultivated material. Meiotic preparations were made following Gill (1971).

* This work was done at the University of Waterloo,
Ontario, Canada.

From a study of this living material and the extensive herbarium* collection, it became apparent that three main variational trends exist in North America. It was concluded that these are best treated as subspecies. They consist of:

- 1) plants of the Great Lakes region - characterized by bushy habit, thin pubescence, glossy dark green foliage, rich magenta pink flowers, narrow oblong-lanceolate leaves, and spinescent spreading subulate calyx teeth (subsp. arenicola).
- 2) plants of the prairies - characterized by little branched erect habit, dense pilose pubescence with very viscid short glandular hairs, dull greyish green foliage, pale pink flowers, ovate-lanceolate leaves, and soft erect broadly lanceolate calyx teeth (subsp. pilosa).

All the plants belonging to both these types that were grown in the garden retained their characters under cultivation, and they clearly represent distinct ecological races adapted to the particular conditions prevailing in these 2 very different regions.

- 3) However, the situation is complicated by the occurrence of more or less intermediate plants. These occur in the Atlantic regions of Canada and the north eastern United States, and also extend westwards as isolated, though large colonies as far west as Wisconsin and the Lakehead area of Ontario, and northwards to James Bay. The occurrence of such intermediates is perhaps readily explicable in the more westerly areas where it is conceivable that both subspecies may have come into contact and hybridized. However, the abundance and predominance of these apparent intermediates in the Atlantic region, far removed from the prairie subspecies is inexplicable on the basis of hybridization between adjoining populations. The intermediate plants are variable and are apparently morphologically the same as the European populations of this species. But the European populations are different cytologically with $2n=102$ (Morton 1973. Wilcock & Jones 1974). Hence, a possible

* ACAD, ALTA, CAN, DAD, HAM, MCM, MT, MTJB, MTMG, NFLD, DAC, QK, QMP, QPH, QFA, QFS, QUE, SASK, TRT, USAS, UWO, UBC, V, WIN, WINF, CM, PFES, VC, WLU, Lakehead University, University of Waterloo & J.K. Morton.

explanation lies in the occurrence of this European type in eastern North America, either as an introduction or more probably as a native. Many European species occur in eastern North America and show an amphiatlantic distribution, being absent from central and western North America (e.g., Satureja vulgaris). According to Blackett et al. (1965), the dispersal of such species over what is now the Atlantic, occurred either during the late Tertiary or in the early Pleistocene when continental drift separated the continents and severed the last land connections.

These intermediate plants, though variable from population to population, retain their characters in cultivation. Usually they look like the Great Lakes type but have a broader inflorescence, broader, larger leaves, less spinescent, partially lanceolate calyx teeth, and a rather dense long pubescence, but they are not viscid. As they appear to be inseparable from the European plant (to which Linnaeus gave the specific epithet) it seems best to include them in the type subspecies - palustris. Experimental work is needed to determine the relationship of these North American and European populations. However, until evidence to the contrary is available, the needs of the taxonomist would appear best served by equating the North American and European populations. Accordingly, in North America, I am of the opinion that Stachys palustris is represented by 3 subspecies. A key and the full descriptions of these are given below:

Key to the subspecies

- | | |
|---|---------------|
| Stem green; inflorescence lacking
purple pigmentation | 1 |
| Stem purplish grey; inflorescence with
purple pigmentation..... | 2 |
| 1. Stem angles with long spreading hair
without pustulate bases; nodal
tuft of hairs absent, calyx teeth
soft and broadly triangular | <u>pilosa</u> |



FIG. 1

Stem angles with reflexed hair with pustulate bases; nodal tuft of hairs present- calyx teeth acuminate and narrowly triangular palustris

2. Stem angles with long stiff hair with pustulate bases, nodal tuft of hairs present- calyx teeth outwardly curved; woody with subulate tips.. arenicola

S. palustris ssp. pilosa
(Fig. 1)

Stoloniferous perennial viscid glandular herb about 40-90 cm. high; stem dull green with long loose spreading hair on the angles; hairs usually without pustulate bases; sides of stem short pilose; nodal tuft of hairs absent; leaves acute narrowly ovate to ovate-lanceolate, shortly petiolate, rounded to subcordate at the base, coarsely serrate, dull grey green, 4-10 cm. x 2-3 cm., densely pilose above and softly pubescent beneath along the veins. Inflorescence lacking purple pigmentation, flowers in distant whorls forming a spike up to 40 cm. long and 1.7 cm. broad, bracts serrate; ciliate; calyx dull green with long spreading silky hair; with short glandular and long eglandular hairs; calyx tube 4 mm., long, campanulate, eglandular inside; calyx teeth 3-5 mm. soft, broadly triangular; straight, (Fig. 4), corolla 12-15 mm. long pale pink.

Exciccatae.

- Bailey 270 Blackie, Alberta
 Bird 73 Vermillion, Alberta
 Calvert s.n. Mahor, Saskatchewan
 - ditto - Cross lake, Minnesota
 Cody & Loan 4445 Pt. Fitzgerald, Alberta
 Dore 11716 Lethbridge, Alberta
 Gardener 64 Churchill, Manitoba
 Hodges 89 Calgary, Alberta
 Morton N.A. 3788 Vermillion, Alberta
 " N.A. 3815 Fort Saskatchewan Alberta
 " N.A. 3415 Calgary, Alberta
 " N.A. 1897 Gunn, Alberta
 " N.A. 3884 Cyprus Hills, Alberta
 " N.A. 3774 Moose Mts. Provincial
 Park Saskatchewan
 " N.A. 3888 Regina, Saskatchewan
 " N.A. 3444 McLean, Saskatchewan
 " N.A. 1801 Red Jacket, Saskatchewan
 " N.A. 3769 Brandon, Manitoba
 " N.A. 3754 Rennie Manitoba

Moss 5037 Gull Lake, Alberta
 Packer 25907 Morely, Alberta
 Raup 3174 Bufflo Park, Alberta
 11575 Fort Nelson, British Columbia
 3179 McMurry, Alberta

S. palustris ssp. arenicola

(Fig. 2)

Stoloniferous perennial non viscid herb, 40-90 cm. high; stems branched from the base, purplish grey, angles with long spreading or reflexed stiff hairs with pustulate bases; nodes with a tuft of cilia; leaves acute, oblong-lanceolate, rounded at the base, sessile, closely crenate, dark to more or less glossy, 4-13 cm. x 1-3 cm., upper surface thinly appressed pubescent, lower surface hispid along the veins. Inflorescence purple, 1.5 cm. in breadth, whorls dense; close at first and then elongate into interrupted spike up to 15 cm. in length; bracts closely serrate; ciliate, longer than the calyx; calyx purple, glandular; 8 mm. long with few long hair on the teeth and nerves; teeth outwardly curved; woody with subulate tip; (Fig. 4); corolla 8-11 mm. long dark purple.

Exciccatae.

Calvert 536 Delaware, Ontario
 Erskine 1361 Wellington, Prince Co., Prince Edward Islands
 Gaiser 254 Walpole Island, Ontario
 Gill and Morton N.A. 3177 Fergus, Ontario
 Gill and Morton N.A. 3174 Flora, Ontario
 Montgomery 142 Port Credit, Ontario
 Montgomery 712 Bridgeport, Ontario
 Morton N.A. 3242 Long Sault Park, Ontario
 " N.A. 4366 Lake Simcoe, Ontario
 " N.A. 3190 Waterloo, Ontario
 " N.A. 3489 Port Buswell, Ontario
 " N.A. 3902A Yamaska, Quebec
 " N.A. 3244 Mississquoi Bay, Quebec
 " N.A. 4223 St. John Fredericton, New Brunswick
 " N.A. 3235 Crail Island, Long Sault, New York
 Rolland-Germain 2256 St. Adolphe, Quebec
 Scoggan 12370 Hampton, New Brunswick
 Scotts s.n. Toronto Island, Ontario
 Senn 5586 Muskoka, Ontario
 Shumovich 224 Whitby Twp., Ontario

S. palustris ssp. palustris

(Fig. 3)



FIG. 2



FIG. 3



FIG. 5

Stoloniferous perennial herb about 40-100 cm., stem green with stout reflexed hairs with pustulate bases, nodes with tuft of hair, leaves narrowly oblong-lanceolate or linear lanceolate; rounded or subcordate at the base lower leaves shortly petiolate, the upper sessile, bracts linear large. Inflorescence broader up to 2.2 cm., flowers in whorls forming an interrupted spike 20 to 30 cm., calyx 8 mm., campanulate; with long hairs, teeth acuminate, narrowly triangular but not woody (Fig. 4), corolla 12-14 mm. purple pubescent outside.

Exciccatae.

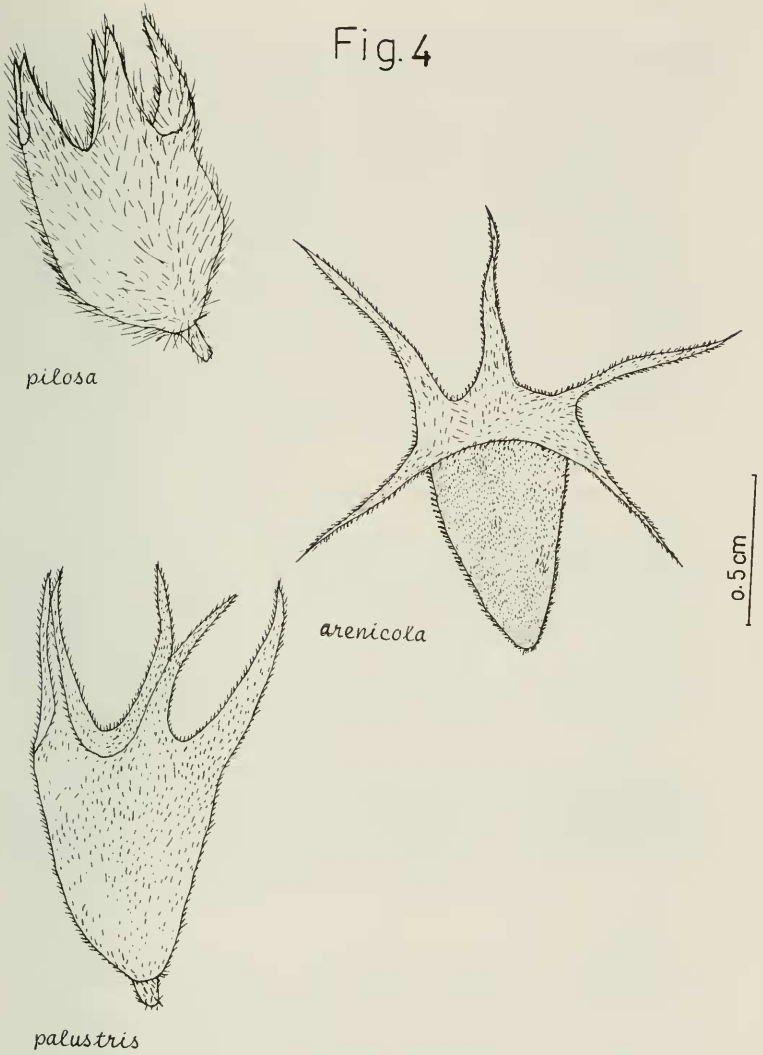
- Blain et al 7522 Riviere du Loup, Quebec
 Dion and Hamel 43259 Yamaska, Quebec
 Hamel and Brisson 14978 St. Francois, Quebec
 O.E. and G.K. Jennings 6944 Nipigon Lake, Ontario
 - ditto - 7001 Qubabika Post, Ontario
 - ditto - 6636 Orient Bay, Ontario
 - ditto - 15052 Jarvis Lake, Ontario
 - ditto - 11031 Pelican Lake, Ontario
 - ditto - 2261 Kakabeka, Ontario
 Marie s.n. (GFA.55348) La Trappe, Quebec
 " s.n. (QFA.05024) Vandreuil, Quebec
 Morin 451 Neuville, Quebec
 Morton N.A. 4186 St. Simeon, Quebec
 " N.A. 4017 Rimouski, Quebec

Nomenclature

Stachys palustris was described by Linnaeus (1753). Subsequent workers in Europe have described many so called species and infraspecific taxa which are currently included in this species. However, of these only the type subspecies occurs in North America, though some of ~~the~~ material from this continent has been erroneously equated with the presumed hybrid between S. palustris and S. sylvatica (S. x ambigua Smith, e.g. by Epling 1934). This hybrid is of locally common occurrence in Western Europe, but does not occur in North America and the other parent - S. sylvatica is only very rarely encountered as an introduction.

Many taxa have been named from North America and several of these names have been taken up by subsequent workers and used for different entities. Hence much confusion now prevails, not only as to what taxa exist in North America, but also as to the correct names of these taxa. From a careful study of the literature, and of most of the type specimens, the following synonymy has been produced for the 3 subspecies which I recognize as occurring in North America.

Fig.4



CALYX STRUCTURE IN SUBSPECIES OF *STACHYS PALUSTRIS*.

Subsp. pilosa

- Epling, 1934, Rep. Sp. No. Regni, Vege, Band LXXX, Dahlem.
S. palustris var. pilosa (Nutt.) Fernald 1943, Rhodora,
 Vol. 45
S. pilosa, Nutt., in Jour. Acad. Phil. 7:48. 1834.
S. teucrifolia Rydb. F1. Colo. 297. 1906.
S. teucrifolia Rydb. in Bull. Torr. Bot. Cl. 31: 640. 1904.
S. asperrima Rydb. in Bull. Torr. Bot. Cl. 36: 682. 1909.
S. leiborgii Rydb. in Bull. Torr. Bot. Cl. 36: 682. 1909.
S. ampla Rydb. in Bull. Torr. Bot. Cl. 36: 683. 1909.
S. borealis Rydb. in Brittonia 1: 95. 1931.
S. malacophylla Greene, in Pittonia 3: 343. 1896.
S. bracteata Greene, in Pittonia 3: 342. 1896
S. rigida Nutt. ex Benth. in DC. Prodr. 12: 742. 1848.
S. ajugoides var. rigida Jeps. & Hoover, in Jeps. F1.
 Calif. 3: 426. 1943.
S. rivularis Heller, in Myhlenbergia 1: 33. 1904.
S. rigida ssp. rivularis Epling, Fedde Rep. sp. nov.
 Beih 80: 60. 1934.
S. rigida ssp. quercetorum Epling, Fedde Rep. sp. nov.
 Beih 80: 60. 1934.
S. quercetorum Heller, in Muhlenbergia 2: 318. 1907.
S. gracilentia Heller, in Muhlenbergia 2: 319. 1907.
S. viarum Heller, in Muhlenbergia 2: 316. 1907.
S. ramosa Heller, in Myhlenbergia 1: 116. 1906.

Subsp. arenicola L.S. Gill Stat. nov.

- S. arenicola Britt. Man. F1. N.U.S. 792. 1901.
S. palustris var. arenicola Farw. in Am. Midl. Nat.
 11: 82. 1928.
S. palustris var. homotricha Fern. in Rhodora 10: 85. 1908.
S. schweinitzii Rydb. in Brittonia 1: 95. 1931.
S. puberula Rydb. in Brittonia 1: 96. 1931.
S. pustulosa Rydb. in Brittonia 1: 95. 1931.
S. palustris var. phaneropoda Fern. in Rhodora 45: 475. 1945.
S. homotricha (Fern.) Rydb. in Brittonia 1: 95. 1931.

Subsp. palustris

- S. palustris L. sp. Pl. 580. 1753.
S. palustris var. puberula Jennings, in Jour. Wash Acad.
 Sci. 10: 458. 1920.
S. palustris var. macrocalyx Jennings, in Jour. Wash Acad.
 Sci. 10: 458. 1920.
S. palustris var. nipigonensis Jennings, in Jour. Wash
 Acad. Sci. 10: 458. 1920.

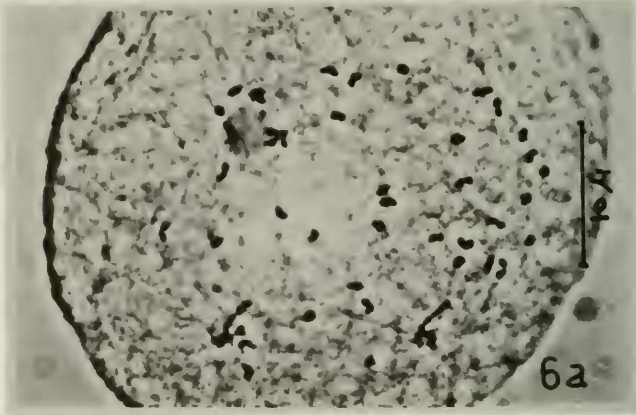
Cytology:

Sixteen populations of *Stachys palustris* (Table 1) from widely scattered localities in North America have been examined cytologically, and all but one proved to have a haploid number of 32 (Fig. 5). These included representatives of all three subspecies. A single population, which came from near Fredericton and was referable to subspecies *palustris* had a haploid number of 48 (Fig. 6a, 6b). It did not differ morphologically from other material of this subspecies and was fully fertile. Meiosis and pollen formation in all three subspecies are normal. Pollen size in both cytotypes is variable and ranges from 20.0 μ to 30.0 μ with a mean of 25.0 μ . European material of *S. palustris* is reported as having $2n=64$ (Wulf 1938, Rohweder 1937), $2n=102$ (Long 1940, Löve 1954, Morton 1973 and Wilcock & Jones 1974). However, Wilcock & Jones (1974) reported also different chromosome numbers ranging from $2n=97-103$, but nothing is known about the distribution of these cytotypes in Europe.

Distribution: (Fig. 7).

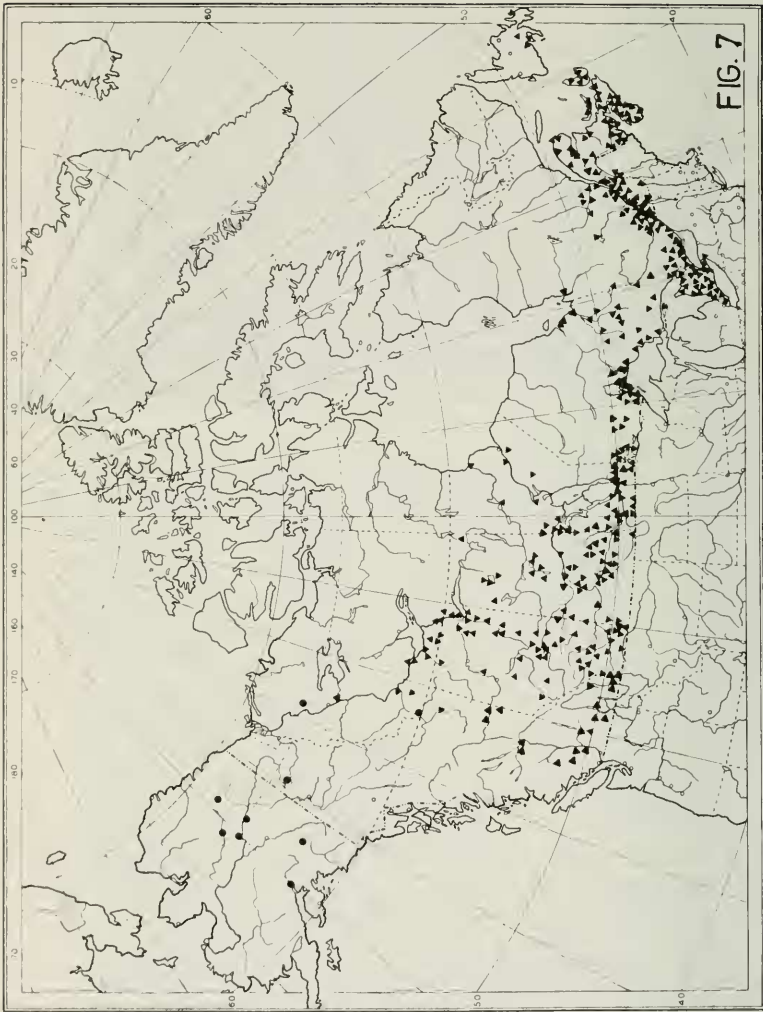
The distribution of the 3 subspecies is at this stage incompletely known. However, the species extends from Alaska, Hudson Bay and Newfoundland southwards to North Carolina, Illinois, Colorado and California. It is apparently absent from the west side of the Rockies. The northern limit (lat. 65°N., long. 126°W.), shows a correlation with the July isotherm of 60°F., and the -20°F. January isotherm. In the British Isles, the northern limit follows the July isotherm of 54°F. (Perring & Walters, 1962). Flowers from June to September.

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origin of Stachys x ambigua Sm. Watsonia 10: 139-147.
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Angiospermen Flora, 11. Ber. Deutsch Bot. Ges.
56: 247-254.



STACHYS PALUSTRIS L.

Table I. Material of Stachys palustris examined cytologically

Origin	*Voucher	n
Bonaventure and St. Simeon, Gaspé, Quebec.	N.A. 4186	32
Fredricton, New Brunswick	N.A. 4223	48
Fredricton, New Brunswick.	N.A. 4225	32
Mississique Bay, Quebec.	N.A. 3244	32
Belleville, Ontario.	Can. 64	32
Si bly Peninsula, Ontario.	Can. 94	32
Port Arthur, Ontario.	Can. 100	32
Kakabeka falls, Ontario	Can. 102	32
Kapuskasing, route 11, Ont.	Can. 106	32
Balls falls, Ontario.	Can. 276	32
Luther Lake, Ontario.	N.A. 3075	32
Flora, Ontario.	N.A. 3174	32
Port Burwell.	N.A. 3489	32
Brandon, Manitoba.	N.A. 3769	32
Vermillion, Alberta.	N.A. 3787 ^b	32
Calgary, Alberta.	N.A. 3415	32

* Voucher material of the above collections is housed in the herbarium of the Department of Biology, University of Waterloo, Ontario, Canada.

The designations Can. and N.A. refer to the material collected by L.S. Gill and J.K. Morton respectively.